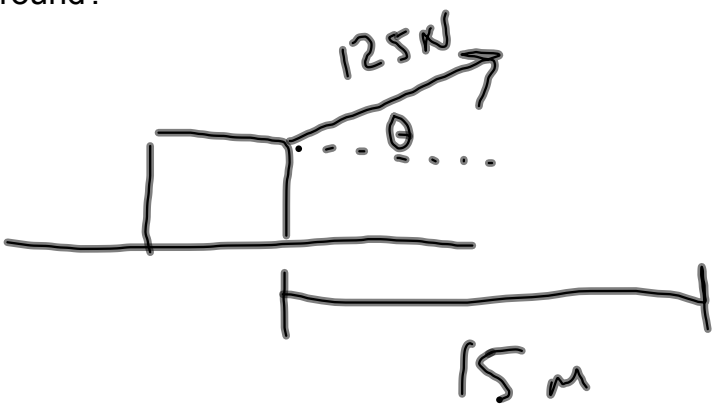
A rope attached to an 18.0 kg crate is pulled with 125.0 N at a certain angle from a frictionless surface. The crate is dragged 15.0 meters along the ground, and it takes 1400.5 J to accomplish the pull. What angle is the rope being pulled, relative to the ground?



$W = 1400.5\ J$

$$W = F d \cos\theta$$

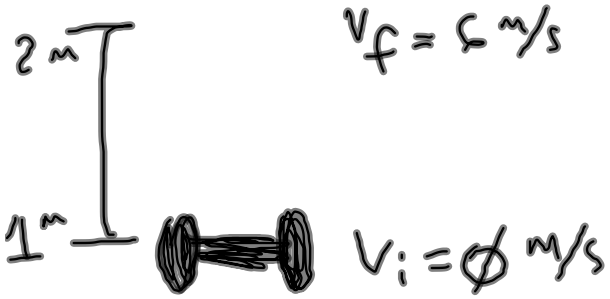
$$\cos\theta = \frac{W}{Fd}$$

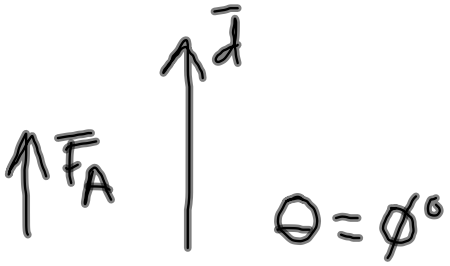
$$\theta = \cos^{-1}\left[\frac{W}{Fd}\right]$$

$$= \cos^{-1}\left[\frac{1400.5\ J}{(125\ N)(15\ m)}\right]$$

$$= 41.7^{\circ}$$

A 5 kg dumbbell is lifted from rest straight up from a height of 1 m to a height of 2 m. If the velocity of the dumbbell is 6 m/s at 2 m, what is the applied force necessary to raise the dumbbell?





$$W = (K_f - K_i) + (U_{gf} - U_{gi})$$

$$\tfrac{1}{2}mv_f^2 - \tfrac{1}{2}mv_i^2 + mgh_f - mgh_i$$

$$F_A d \cos\theta = \tfrac{1}{2}m(v_f^2 - v_i^2) + mg(h_f - h_i)$$

$$F_A = \frac{1}{d}\left[\tfrac{1}{2}mv_f^2 + mg(h_f - h_i)\right]$$

$$= \frac{1}{(1\,m)}\left[\tfrac{1}{2}(5\,kg)(6\,m/s)^2 + (5\,kg)(9.8\,m/s^2)(2\,m - 1\,m)\right]$$

$$= 139\,N$$